

Physics-Based Identification, Modeling and Risk Management for Aeroelastic Flutter and Limit-Cycle Oscillations (LCO), Phase I

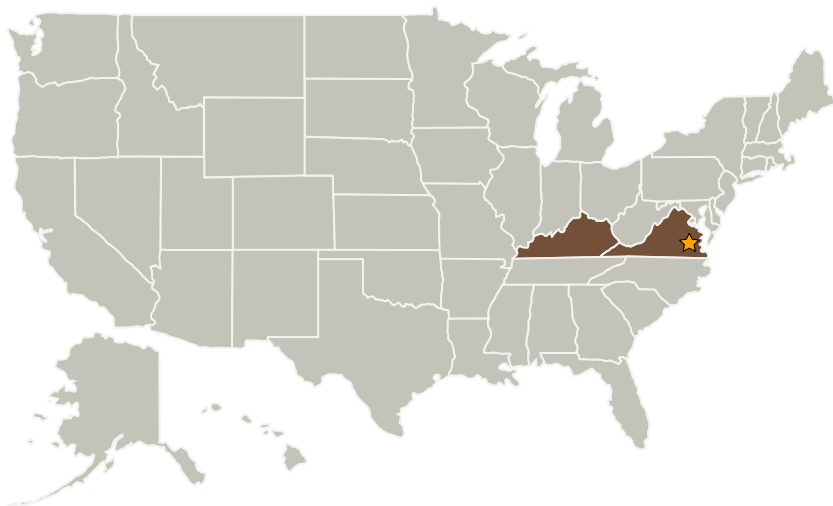
Completed Technology Project (2009 - 2009)



Project Introduction

The proposed research program will develop a physics-based identification, modeling and risk management infrastructure for aeroelastic transonic flutter and limit-cycle oscillations (LCO). This capability will be built upon high fidelity state-of-the-art theoretical/computational methods as validated and verified by available experimental data bases, and will include (1) rapid flutter boundary determination for a wide range of configurations; (2) an assessment of the relative importance of various aerodynamic and structural nonlinearities for aircraft and aerospace configurations that are determined to be flutter critical and hence potentially capable of LCO; (3) an assessment of expected LCO amplitudes based upon high fidelity computational models; (4) an assessment of the potential for active and/or passive alleviation of LCO; and (5) a proposed risk management methodology that incorporates a prediction of tolerable LCO amplitudes and the capability for reducing unacceptable LCO response. Key challenges and milestones to be met include (1) a demonstration of the use of Navier-Stokes based CFD models and nonlinear structural models, including the use of system identification methods as appropriate and needed to predict flutter and LCO; (2) a demonstration of accurate modeling of aerodynamic and structural nonlinearities such as large shock wave motion, separated flow, structural freeplay and large geometric structural deflections and their impact on flutter and LCO; (3) characterization and evaluation of nonlinear dampers and nonlinear stiffness devices for alleviating LCO; (4) characterization and evaluation of active control systems for alleviating LCO; and (5) design and demonstration in wind tunnel test and flight test of an LCO alleviation device.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Langley Research Center (LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Advanced Dynamics, Inc.	Supporting Organization	Industry Minority-Owned Business	Lexington, Kentucky

Primary U.S. Work Locations

Kentucky	Virginia
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
 - └ TX15.1 Aerosciences
 - └ TX15.1.3 Aeroelasticity